

11/30 CC: MA Cook
FYI, good report,
Bob is learning and
understanding pretty
rapidly. Ebn

DATE: November 23, 1993
TO: W. Ashton, D. Jones
FROM: R. Denton *R. Denton*
SUBJECT: TRIP REPORT
TALC VALIDATION TEAM MEETING - NOVEMBER 16, 1993
WINDSOR, VERMONT

TUESDAY MORNING MEETING HIGHLIGHTS:

- Flocculant was removed from the process as of 9/28/93 (i.e., just subsequent to farmhouse meeting).
- Luzenac will return to the exclusive use of "conventional" (i.e., horizontal) flotation cells.
- Luzenac has begun investigating possible alternative methods of particle size analysis (e.g., a "dry" coulter counter, etc.), but will continue to utilize the Micromeritics Corporation's "sedigraph" instrument. They have accumulated a large body of data on their talc with this device, and it is one of the most generally accepted methods for mineral particle size analysis in the 0.5 to 50 micron size range. It is also an accepted technique within the talc and mica industries. We expressed concern that the sedigraph, which analyzes samples as an aqueous dispersion, may not give data reflecting the respirable particle distribution. We also brought up the possibility of using an aerodynamic technique (e.g., Aerosizer).
- Luzenac has produced "high, loose bulk density" talc powder by minimal passage of material through the air classifier, thereby increasing the loose bulk density from 25.5 to approx. 27.0 lbs/cu ft..
- Luzenac is placing considerable emphasis on our acceptance of the V-96 special material (< 3.0% acid solubles). We have promised to continue reviewing the data, but expressed great caution in any hasty judgement as to the acceptability of the V-96 grade.
- Randy Corder gave a brief review of the effort to reduce microbial contamination of the talc. Prior to 1986, he mentioned that a large number of talc shipments were rejected due to contamination (spec. is ≤ 100 c.f.u.'s/gram and no harmfuls in 0.1 gram). After chlorination of the dewatering tank was begun (1986), there have been no rejections based on microbial content. However, due to technical problems with the chlorination (i.e., pH control, destruction of equipment due to corrosive HCl vapor, etc.) there continues to be emphasis on the acceptance of a brominating agent for microbial control. However Luzenac will keep the process as it currently is being run.

- In order to create a "benchmark" talc for our characterization and specification work, we agreed that there will be a "moratorium" on any further process changes, to avoid chasing a "moving target" on particle size, odor changes, density, etc..

Here is a summary of major ore reduction/purification ("front-end") processing changes over the past 16 years.

Pre-1976

Crusher-----Roller Mill---Delaminator-----Flotation*-----Dewatering-----Finishing

1976-1991

Crusher-----Roller Mill---Shear Disc-----Flotation*-----Dewatering-----Finishing

1991-1993

Crusher-----Roller Mill---Shear Disc-----Flotation-----Dewatering-----Vertical Mill-----Fin.

1993 to present

Crusher-----Roller Mill---Shear Disc---Flotation*---Dewatering-----Air Classifier Mill---Fin.

Planned Changes (1994 Onward)

Crusher-----Roller Mill-----Flotation*---Dewatering-----Air Classifier Mill---Fin.

(*-indicates use of "conventional" flotation cells.)

- We will be provided with samples of the processing stream from immediately before and after the shear disc. Johnson & Johnson (Bob Denton) will analyze these samples for any changes in morphology, surface area, surface energy, and especially delamination or edge rounding. Until this analysis is carried out and the results evaluated, the shear disc will not be removed from the process stream.

PLANT AND MINE TOUR:

Ore Typology:

- High Grade, "A" Type - Platy, opaque, schist-like fracturing, wavelly banded ore with large talc crystal plates. Often with smoky quartz inclusions occurring as lens shaped pods. Very soft, and easily delaminated (sheets can be separated with a pocket knife or fingernail). Low carbonate level (< 35 percent solubles). Usually occurs at the margins of the ore body (shear zone).
- "B" Type - Fine platy to granular, grainy fracture, semi-translucent ore. Ham material is typically light green with dark magnetite and chlorite inclusions. Contains from 45 percent to 35 percent solubles (moderate carbonate level). Makes up the majority of the commercially useful cosmetic talc ore body at the Ham mine. Harder than high grade ore.

- "C" Type - Dark colored, translucent, granular ore with a grainy fracture. Ham material is greenish gray with numerous dark inclusions of magnetite and chlorite. High carbonate level (>45 percent soluble material). Highest hardness of all commercially useful cosmetic ores due to high magnesite levels.

PLANT TOUR HIGHLIGHTS: (Conducted by M. Keener)

- Use of too much high grade ore has had a history of producing "slimes" which tended to block up the filters. This was attributed to the fact that the high grade ore delaminated easily into very thin, soft talc plates which tended to yield a large amount of fines during the grinding process. Both the fines and the thin plates contributed to the clogging of the filters and production of excessive foam during flotation.
- Higher carbonate rocks ("B" and "C" type ores) were easier to crush, float, filter, and processed more efficiently in general. Thus, quantities of the "B" and "C" type ore were blended into the high grade material even when Hammondsville was in operation, especially after the advent of continuous mining techniques. However, the exact percentages used in this blending at Hammondsville are currently unknown.
- The Ham production has consisted of primarily "B" grade ore, although as much as 10 to 15 percent of the "A" type ore continues to be mined there. The quantities of "A" ore incorporated into the grind could be even higher, but this facies often contains an unacceptable level of arsenides at this locality.
- All column flotation tanks were removed from process in late 1992. Column flotation was never used exclusively as the material produced by this technique tended to be inconsistent in quality.

MINE TOUR HIGHLIGHTS: (Conducted by Lance Meade)

- Polished thin sections are prepared as part of the prospecting routine to assess crystallinity and mineral types in the bench extensions.
- Hammondsville Mine (open pit/underground - Reading, Vermont) is at the north end of the Chester Dome structural zone. R. Denton collected a sample of a high grade (type A) ore. Lance explained that the underground mining operation was probably* more selective than the current surface mining techniques, and utilized a mixture of primarily high grade and "B" type ore.

*(Note- The specifics of the mining operation at Hammondsville are uncertain, as most of the pre-Luzenac records were destroyed by the mine management staff just prior to the J&J divestiture and the Cyprus purchase. However, several former Hammondsville miners are still employed at the Ham mine, and they provided us with useful information as to the nature of the underground works.)



- Ham mine (Open pit- Windham, Vermont) is on the western flank of the Chester Dome. Although the ore body exhibits a steeper dip, the basic geological setting is similar to Hammondsville. The ore bodies at both localities are theorized to have originated as serpentinites which were altered by acidic aqueous intrusions to magnesite (magnesium carbonate). Then, the magnesite was partially altered to talc by the intrusion of water-containing dissolved silica into a process known as "steatization". This incomplete steatization gave rise to a biphasic rock containing both talc and magnesite, the so-called "Talc Carbonate".
- The country rock in both locations varies from a phyllosilicate schist (hanging wall) to a garnetiferous gneiss (footwall), with the ore body lying in between. There is an adjacent deposit of serpentine, grading into the magnesite facies, which has been steatized outwards forming the commercially usable talc. At both locations the flaky high grade ore (A type) is a border deposit lying in the shear zones, especially near the contact with the schist (although there are intraformational shear zones as well).

c: **Skillman:**

R. Gallagher
A. Kulkarni
E. Lukenbach
V. McCluskey
J. Molnar
K. Scisorek

Royston:

R. Corder
D. Dye
J. Flaska
M. Roser